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Cushing Parkway Bridge (Fremont, California)
Bridge Expert *(2004)* Reviewing and advising the City of Fremont on design, analysis, construction, and proposed repair procedures for a multi-span reinforced concrete slab bridge that was observed to have excessive deflections at the end of its construction.

Indian River Inlet Bridge (Delaware)
Engineering Consultant *(2004)* Served on a constructability review panel for a 1000 ft span arch bridge carrying Delaware Rt. 1 across an inlet in the barrier islands between the Atlantic Ocean and Rehoboth Bay / Indian River Bay. The single arch rib, on the centerline of the bridge, is planned for cast-in-place segmental construction, with tie-back cables to provide wind stability.

Bay Division Pipeline Nos. 1 & 2 San Francisco Bay Crossing at Dumbarton (California)
Project Manager *(2004-present)* Leading a team providing geotechnical exploration, seismic hazard assessment, inspection, testing, structural studies, and retrofit / rehabilitation strategy for the 1927 bay crossing that delivers water from Hetch Hetchy Reservior in Yosemite Park to San Francisco. The project includes buried and bridge-supported steel water pipelines up to 76" diameter.

Quad Graphics Storage Rack Collapse Investigation (Lomira, Wisconsin)
Lead Engineer *(2003 – present)* Evaluated causes of collapse and conformance of design with criteria, for a steel storage rack structure 780 ft long, 105 ft tall, and 88 ft wide. Scope includes design review, field observation, and analytical studies of the original design.

Bandung Bridge (Bandung, Malaysia)
Lead Engineer *(2003)* Prepared alternative conceptual designs for curved cable-stayed and arch bridges to serve as landmark gateways to a Bandung development zone. Supervised type selection from these alternatives. Prepared bridge design through design development, supervised and reviewed detail design and construction documents prepared by a Singapore firm.

New Beijing Poly Plaza (Beijing, China)
Engineering Consultant *(2003-2004)* Consulted on design of a 23-story triangular shaped building with a large open atrium enclosed by a cable-stiffened glass wall. Within the atrium, a segment of the building is suspended by cables from the primary vertical and lateral framing systems.

nD-Structible television pilot, commissioned by the Discovery Channel (California)
Engineering Consultant *(2003)* Served as engineering consultant to Michael Hoff Productions for the creation of a television program pilot in which teams of backyard engineers are challenged to craft a bridge from uncommon materials, and then attempt to destroy the other team's creation.

San Francisco – Oakland Bay Bridge, Self-Anchored Suspension Spans (California)
Lead Engineer *(2003)* Provided engineering services to IHI in support of bid preparation. Various design and analysis tasks were performed, including complete design of the temporary structures for support of the bridge deck during erection. These structures serve as erection platforms, and are required to meet strict performance criteria for seismic, wind, and ship impact.

Benicia – Martinez Bridge Foundations (California)
Bridge Expert *(2003)* Served on a Value Engineering panel for the California Department of Transportation, to evaluate construction options for foundations of this multi-span concrete segmental bridge across the Sacramento River on I-680 near San Francisco.

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Shenzhen Western Corridor Bridge (Shenzhen, China)
Supervising Engineer *(2002 – 2004)* Performed design verification studies of a 3.8 km long bridge at the Hong Kong boundary. The channel spans will be asymmetrical single-tower cable-stayed bridge with span length up to 210 m. Reviewed wind, seismic, durability, and pavement design.

Influence of Design Ground Motion Level on Bridge Costs (PEER Center, California)
Principal Investigator *(2002-2003)* Performed research funded under the Pacific Earthquake Engineering Research Center, Lifeline Systems Program to evaluate design ground motion vs. construction cost functions for typical highway bridges built in California.

East 153rd Street Bridge (New York City)
Bridge Expert *(2002)* Served on a Value Engineering panel for the New York Department of Transportation, to evaluate design and construction options for this signature cable-stayed bridge across rail right-of-way near Yankee Stadium.

Sixteenth Street Pedestrian Bridge (Denver, Colorado)
Engineering Consultant *(2002)* Performed dynamic assessment of a unique pedestrian bridge with a flared truss design. The studies concluded that the design is sensitive to wind- and pedestrian-induced self-excited oscillations. Tuned mass and viscous damper solutions were developed.

George Washington Bridge Orthotropic Deck Studies (New York City)
Engineering Consultant *(2002)* Consulted on criteria, design, and analysis for a study of rearticulating the orthotropic steel deck. Prepared and analyzed a computer model of the complete bridge, for use in rapid prototyping of alternative strategies and validating a more detailed model.

Nanning Bridge (Nanning City, China)
Technical Lead Engineer *(2001 – present)* for design development of a curved 300m span through-arch bridge with orthotropic deck steel box girder, suspended from inclined steel box arch ribs. Supervised and performed shape-finding studies, design, and analytical studies for wind, seismic, global elastic stability, component capacities, design validation, and construction staging.

Old Lahaina Luau SkyCover® (Maui, Hawaii)
Engineering Consultant *(2001)* Consulted on design of a retractable roof for an outdoor performance venue. Dimensioned the static components, and worked with SkyCover® patent holder to dimension and demonstrate performance of the retractable covering system.

Benicia – Martinez Pre-Bid Services (California)
Lead Engineer *(2001)* Provided pre-bid services to Shimmick Construction. Developed erection programs, loads and strength demands on erection equipment, and evaluated prestressing layouts for a 17-span, 2266-meter-long cast-in-place segmental cantilever crossing of the Sacramento River.

Rama IX Bridge 10th Year Inspection & Evaluation (Bangkok, Thailand)
Lead Engineer *(2000-2001)* Led structural component of a multi-discipline evaluation of this 450m span cable-stayed bridge, the longest span single-plane cable-stayed bridge in the world. Performed on-site inspections, prepared 3-D dynamic computer models for live load vibration analysis, performed fatigue life assessment, and consulted on design of real-time health monitoring system.

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Santa Rosa Creek Bridge Collapse Investigation (Santa Barbara County, California)
Project Manager and Lead Engineer *(2000)* Evaluated causes of collapse and conformance of design with mandated criteria, for a temporary modular bridge that carried traffic across a creek during construction of a permanent bridge slated to replace a storm damaged span.

SFIA Offshore Runway Study (San Francisco Bay, California)
Lead Engineer *(2000)* Prepared alternatives analysis and conceptual design for runway extensions to be built using segmental bridge technology. Substructure consisted of cast-in-place concrete piles, and carbon-fiber confined columns. Superstructure consisted of post-tensioned precast segments.

Maumee River Bridge (Toledo, Ohio)
Bridge Expert *(2000)* Served on a Value Engineering panel for the Ohio Department of Transportation, to evaluate design and construction options for this signature cable-stayed bridge with two 600 ft spans, and its precast segmental approach viaducts and interchanges.

LAXT Coke Storage Domes (San Pedro, California)
Principal Engineer *(1999-2000)* Supervised design of two reinforced concrete domes, 240 feet in diameter and 140 feet tall, for petroleum coke storage, with reclaim tunnels and entry buildings. The domes were constructed from within using the airform process. Performed extensive seismic evaluation and design to meet performance requirements on the soft soil site.

Cala Foods Building (San Francisco, California)
Project Manager and Lead Engineer *(1999-present)* Performing ongoing engineering studies, designs, and construction supervision for maintenance and rehabilitation of a unique building with a concrete shell roof and a catenary-reinforced light weight concrete floor slab.

Millennium Icon, Walt Disney World (Orlando, Florida)
Lead Engineer *(1999)* The Millennium Icon is a model of Mickey Mouse's gloved-hand, grasping a sorcerer's wand, extending 240 feet into the air and supporting a lighted sign on top of the golf ball-shaped Spaceship Earth. Provided design- and construction- phase services to the Disney Engineers, as part of a wind evaluation and strengthening effort led by the West Wind Laboratory.

Third Carquinez Strait Bridge (California)
Engineering Consultant *(1996)* for studies of arch, truss, cable-stayed, and suspension alternatives. Engaged by Caltrans under a constructability review contract to provide conceptual design, cost estimates, construction schedules, and seismic reviews to support initial type selection studies.
Bridge Design Manager *(1996-1998)* for preliminary design through design development of cable stayed and suspension alternatives. Led design efforts on 730m span suspension options and 360m span cable stayed options, including seismic, aerodynamic, and constructability evaluations. Provided 35% plans, cost estimation, and construction schedule for two bridge structures.
Lead Engineer, Performance Assessment *(1998-2001)* for final bridge design, responsible for seismic assessment using inelastic time history analysis, aerodynamic assessment using wind tunnel tests and computer analysis, service load assessment, and independent validation of component designs.

HABS/HAER Recordation of the San Francisco – Oakland Bay Bridge (California)
Engineering Consultant *(1998-1999)* Provided structural/bridge engineering component to a multi-discipline historical recordation of the Bay Bridge, filed in the U.S. Library of Congress.

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Bay Division Pipeline No. 2 at the Hayward Fault Crossing (California)
Project Engineer *(1998)* Performed seismic studies of the 66" diameter, 3/8"wall steel pipe that delivers water from Hetch Hetchy Reservior to the San Francisco Bay Area. 3-D inelastic finite element models of the pipe and soil were evaluated under a 5-foot fault offset. Parameter studies were performed to provide engineering guidance to Geomatrix in selection of retrofit strategy.

Koror - Babeldaob Bridge Collapse Investigation (Palau, Micronesia)
Lead Engineer *(1998)* Evaluated causes of collapse of this 790 ft span post-tensioned concrete box girder bridge. Scope included design review, field observation, and analytical studies of the original design, remedial measures, time-dependent behavior, and demands vs. capacities.

BART Stations, San Francisco Airport Extension (California)
Principal Engineer *(1997-2001)* Designed the South San Francisco, San Bruno, and Millbrae Stations South San Francisco and San Bruno are conventional designs, Millbrae is a multi-mode BART/Rail station, that incorporates a vaulted, cable stayed roof with tubular steel frame and fabric covering.

Seismic Analysis of Large Caisson Foundations (NCEER, New York)
Research Engineer *(1997-1998)* Performed research funded by the National Center for Earthquake Engineering Research, to evaluate applicable technologies for detailed seismic evaluation of large caisson foundations such as use for deep-water foundations of bridges.

Arroyo Cangrejillo Bridge (Argentina)
Supervising Engineer *(1997-1998)* Supervised concept development, design, analysis, and construction support of an award-winning 340m catenary cable bridge that carries a foot path and copper concentrate pipeline over a remote mountain valley. Included aerodynamic and seismic studies, development of cable details, and vibration studies.

Bath – Woolwich Bridge (Maine)
Project Engineer *(1997)* Participated in design of a precast segmental bridge in response to a design-build contractor solicitation. Focused on segmental technology and seismic components.

Grain and Meal Storage Domes (Istanbul, Turkey)
Project Manager *(1997)* Designed four interlocking 43m diameter airform concrete domes spaced at 32m centers. 14m semi-circular walls separate the dome chambers at the intersections. Foundations consists of circumferential rings with grade beams spanning each intersection opening.

Berkeley I-80 Pedestrian/Bicycle Overcrossing (California)
Principal Engineer *(1996-2000)* for site selection, concept development, and final design of an award-winning 90m span basket-handle arch bridge to carry pedestrians and human-powered vehicles across the I-80 freeway. The project includes the freeway crossing, curved sloping approach ramps and touchdown plazas, and wetland encroachment mitigations.

Pittsburg Marine Terminal Petroleum Coke Storage Domes, Pittsburg (California)
Project Manager *(1996-1997)* Designed three reinforced concrete 160 ft. diameter hemispherical domes for storage of petroleum coke. The domes were constructed from within using the airform process. Performed design studies using finite element analysis for construction sequence, service loads (retained material pressures), and seismic, and foundation subsidence for this soft soil site.

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Strait of Gibraltar Bridge Concept and Performance Studies (Spain-Morocco)
Principal Engineer *(1996)* Prepared alternative concept designs for a 14km crossing with maximum span of 5km. Performed analytical studies of bridge performance under dynamic loads including wind, to assess the validity of various alternatives for providing strength and rigidity.

San Francisco – Oakland Bay Bridge, East Bay Crossing Replacement (California)
Bridge Expert *(1996)* Served on a Value Engineering panel that evaluated retrofit options and developed replacement options for this 60 year old bridge, with the objective of establishing a preferred alternative and implementation procedure. The preferred option – a multi-span viaduct with cable-supported channel span – was adopted for final design.

Bi-Tan Pedestrian Bridge (Taipei, Taiwan, R.O.C.)
Project Manager *(1996)* Designed a 133m span suspension bridge for pedestrian access across Hsintien Creek. The concrete edge-girder deck is supported by inclined suspenders, twisted strand cables, and reinforced concrete A-frame towers.

Arroyo Seco Arch Bridge Seismic Retrofit (Pasadena, California)
Supervising Engineer *(1996)* Provided independent check of retrofit design for this 1400-ft long multi-span reinforced concrete arch bridge. Services included verification of modeling and seismic retrofit strategy; verification of the capacity and effectiveness of retrofit measures; and a check of all design drawings, quantities and special provisions.

Three Mile Slough & Steamboat Slough Bridges Seismic Retrofit (California)
Supervising Engineer *(1996)* Consultant to seismic retrofit designer for existing vertical-lift and bascule bridges. Services included consultation on condition evaluation, dynamic modeling, steel member capacity, seismic retrofit strategy, seismic isolation.

San Diego-Coronado Bridge Seismic Evaluation (California)
Project Engineer *(1995-1997)* Provided consultation on seismic evaluation strategy, development of global 3-D dynamic models, response spectra and time history analyses, and review of seismic vulnerability findings for a steel plate girder and box girder bridge with an orthotropic deck.

Elevated Circulation Roads at San Francisco International Airport (California)
Lead Engineer *(1995-1997)* Supervised design of elevated circulation roads that provide highway access to the new International Terminal and parking garages. The structures consist of post-tensioned concrete box girders supported by reinforced concrete bents on pile foundations. Spans vary from 70 to 140 feet; seismic design is to Important Structure, near-fault standards.

City Creek / East Fork City Creek Bridges (San Bernardino National Forest, California)
Principal Engineer (1995-1996) Prepared seismic retrofit design of two historic open spandrel reinforced concrete arch bridges on SR 330. Participated in the Caltrans Arch Retrofit Committee for the Phase II Seismic Retrofit Program to develop arch rib vulnerability evaluation methods.

St. Johns Bridge Seismic Susceptibility Study (Portland, Oregon)
Project Manager *(1995-1996)* Directed a seismic damage susceptibility evaluation of this historic suspension bridge with steel truss approaches and reinforced concrete piers. Services included multi-support time history analysis including soil-structure interaction, and basic retrofit strategy.

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Maysville Kentucky Ohio River Bridge, William H. Harsha Bridge, (Kentucky & Ohio U.S.A.)
Engineering Consultant *(1995-1996)* For this 640m award-winning cable stayed bridge, provided design check including service and extreme events, construction cambers & stresses, cable detailing, and connection detailing of precast floor panels to the structural steel deck grillage.

Monongahela River Bridge (Pittsburgh, Pennsylvania)
Engineering Consultant *(1995)* Provided consultation on design and construction, performed independent analysis, of an 894 ft span steel-rib basket-handle arch busway bridge.

Lake Redding Bridge (Diestelhorst Replacement) (Redding, California)
Design Manager *(1994-1996)* Developed a unique bridge design consisting of a narrow 5-span concrete arch rib supporting a wide post-tensioned concrete deck. Led concept through design development, and final design verification. Developed camber and cable stressing sequence to support proposed segmental construction method.

Hilton Hotel Spectacular Sign (Las Vegas, Nevada)
Engineering Consultant *(1994)* Participated in redesign of a 280 ft tall illuminated sign, the tallest in the world. Contributed to computer modeling and planning/interpretation of wind tunnel tests.

Richmond-San Rafael Bridge Seismic Evaluation (California)
Engineering Consultant *(1994-1995)* Provided consultation on seismic evaluation strategy, local and global modeling, and review of seismic vulnerability findings for this multi-span steel truss bridge.

San Francisco – Oakland Bay Bridge, West Bay Crossing Seismic Evaluation (California)
Project Manager and Lead Engineer *(1993-1994)* Led the seismic evaluation and development of retrofit strategy for this historic 3,140m double deck tandem suspension bridge. Included inelastic multi-support dynamic analyses, soil-foundation-structure interaction analyses, evaluation of inelastic member resistance, retrofit strategy, and construction cost estimates. The final retrofit, designed by Caltrans, is substantially based on the proposed strategy.

High Speed Rail Bridge, Hukou (Taiwan, R.O.C.)
Project Manager *(1993)* Prepared type selection studies and preliminary design for a designated-landmark freeway and highway crossing of the West Taiwan High Speed Rail Project. The 710m long concrete box girder bridge has concrete-encased stays and 140-meter main spans. Services included dynamic analyses for rolling stock in addition to normal design services.

I-5 Widening Aesthetics Study (Anaheim, California)
Engineering Consultant *(1993)* Served on a multi-discipline team commissioned by the City of Anaheim to explore aesthetic alternatives for the planned widening of Interstate 5 (The Golden State Freeway) in Anaheim. Participated in design workshops, proposed structural alternatives for ramps, overpasses, and grade separations.

Ping-Ding Steel Arch Bridge (Taipei, Taiwan, R.O.C.)
Supervising Engineer *(1993)* Supervised the redesign of a concrete girder bridge to as a prestressed concrete arch and a steel arch bridge. Based on aesthetics and a lower construction cost, the client chose to build the 120-meter long, 80-meter main span open spandrel arch bridge with twin steel box ribs and steel spandrel bents as the bridge.

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Tacoma Narrows Bridge Seismic Evaluation (Tacoma, Washington)
Lead Engineer *(1992-1994)* Led the seismic evaluation of the existing 2,800-foot span suspension bridge. Included seismic hazard analysis, synthesis of multi-support ground motions, and inelastic dynamic analysis. OPAC was subsequently engaged - in 2000 - by Washington DOT for follow-up work to support final design of retrofitting measures.

Central Viaduct Seismic Retrofit (San Francisco, California)
Project Engineer *(1992)* Participated in seismic retrofit design of a 2600-foot long double deck concrete viaduct and an adjoining 300-foot long single-level steel viaduct. Services included design, analysis, independent design check, and preparation of staged construction shoring calculations.

H-3, North Halawa Viaduct (Oahu, Hawaii)
Supervising Engineer *(1990-1991)* Supervised preliminary and final design of two 6,000-foot concrete interstate highway viaducts over environmentally sensitive terrain. Performed preliminary design and analyses, and provided guidance for the final design and analyses for a cast-in-place box girder superstructure built by the segmental cantilever construction method.

Sun Yat-Sen Freeway Widening Project (Taipei, Taiwan, R.O.C.)
Supervising Engineer *(1990-1991)* Supervised design of twin elevated structures and interchanges for a new 22-kilometer long freeway within the R.O.W. for an existing freeway. The project contains a variety of bridge types and spans, including 5 kilometers of cast-in-place concrete segmental box girder bridges with spans up to 180 meters in length.

Benicia-Martinez Bridge Preliminary Engineering Study (California)
Project Manager and Lead Engineer *(1990)* Prepared preliminary design, construction schedule, and cost estimates for the new I-680 Benicia-Martinez Bridge across the Sacramento River. The design consists of 528-foot lightweight concrete segmental box girder spans supported on ductile frame piers. This bridge concept was selected for final design and construction.

Golden Gate Bridge Seismic Evaluation and Seismic Retrofit Strategy (California)
Project Manager and Lead Engineer *(1989-1992)* Led the first-of-their-kind precedent-setting seismic vulnerability and retrofit studies of this famous 1280m span suspension bridge. Included ground motion synthesis, criteria development, inelastic dynamic multi-support time history analysis, development of retrofit strategies, construction cost estimates, and extensive reporting.

Golden Gate Bridge Second Deck Study for Rail Transit System (California)
Project Manager and Lead Engineer *(1989-1990)* Evaluated the structural feasibility of building a rail transit system on the Golden Gate Bridge by building a new special purpose steel orthotropic deck beneath the existing highway deck. The studies considered structural layout, preliminary design, 3-D analysis, and studies of deflections, fatigue, and dynamic bridge response.

Mission Trails Parkway/Jackson Drive Bridge (San Diego, California)
Supervising Engineer *(1990)* Supervised preliminary and final design of a four lane, 1,580 foot long segmental prestressed concrete bridge with a main span of 500 feet.

Parrotts Ferry Bridge (Vallecito, California)
Supervising Engineer *(1990)* Supervised evaluation and retrofit studies to address a progressive 22-inch mid-span deflection of the main span of an existing bridge. The bridge is a three-span cast-in-place lightweight concrete post-tensioned single-cell box girder structure with a 640 foot center span and two of 325 foot side spans, built using cast-in-place cantilever segmental construction.

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Rosecrans/Aviation Blvd. and Kramer Bridges (Los Angeles, California)
Supervising Engineer *(1988-1989)* Designed two cast-in-place segmental bridges for the Los Angeles Light Rail System with 320 ft (Rosecrans/Aviation) and 185 ft (Kramer) spans. Performed design studies to assure compliance with strict long-term and live load deflection limitations.

Central Marin Sanitation Agency Sewage Digester Collapse Investigation (California)
Project Engineer *(1988)* Evaluated causes of collapse and a timeline of contributing causes, to settle claims on failure of a floating steel-dome sewage digester roof that collapsed after several years of service. Included field studies, design validation analyses, and collapse contribution analyses.

U.S. Navy Submarine Base Wharves S10 through S14 (Pearl Harbor, Hawaii)
Project Manager *(1988)* Performed a structural investigation of reinforced concrete wharves built between 1925 and 1935. Tasks included inspection, load measurement, material testing, three-dimensional finite element analysis, and load tests.

Benicia-Martinez Bridge Fatigue Evaluation (California)
Project Co-Manager *(1988)* Evaluated the remaining fatigue life of an existing 5610-foot long steel truss bridge with multiple 528-foot spans, using measured stress ranges and vehicular usage records. Developed a fatigue retrofit recommendation, performed as part of a deck widening.

Guy West Bridge (Sacramento, California)
Project Manager *(1987)* Performed a comprehensive structural evaluation, and prepared bidding documents for suspender replacement, for a 600-foot span suspension pedestrian bridge across the American River that was built in 1965 to provide access to the California State University campus.

AASHTO 1989 Guide Specifications for Segmental Bridges
Engineering Consultant *(1986-1987)* Technical consultant on bridge analysis to NCHRP Project 20-7/32, prepared appendices on analysis, stress redistribution, and camber. The project report became the AASHTO "Guide Specification for Design and Construction of Segmental Concrete Bridges".

Segmentally Erected Bridge Research Project (U.C. Berkeley)
Lead Research Engineer *(1984-1986)* Performed FHWA and Caltrans funded research to develop methods of analysis for segmental concrete bridges. This research provided the basis for Dr. Ketchum's contribution to the AASHTO Guide Specifications for Segmental Concrete Bridges.

Post-tensioned Concrete Box Girder Research Project (U.C. Berkeley)
Research Engineer *(1982-1984)* Performed FHWA and Caltrans funded research to develop methods of analysis for post tensioned concrete box girder bridges. Finite element and finite strip programs were developed for analysis of straight, curved, and skew box girder bridges.

SR-182 Columbia River Bridge (Richland, Washington)
Lead Engineer *(1980)* Prepared preliminary design and supervised final design of twin 1,870-foot long by 64-foot wide segmental bridges across the Columbia River, with 450 foot main spans. This project won the 1985 PCI award for excellence in bridge design.

Moscone Convention Center (San Francisco, California)
Design Engineer *(1979)* Participated in design of the main arches of the convention hall, and the exit tunnel girders that both frame the large meeting room and support the lobby roof. Redesigned the exit tunnel girders during construction, with revised prestressing geometry.

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Las Lomas Bridge, (Sonoma, California)
***Engineer** (1979)* Performed engineering studies of this prestressed concrete bridge that failed during construction. The tendons broke free of the webs along the 300-foot radius of the span. Evaluated causes of failure. Designed tendon removal procedure, and repairs and strengthening measures.

Dumbarton Bridge, (San Francisco Bay, California)
***Engineer** (1979)* Provided construction-phase services to bridge construction contractor, focusing on erection bracing of the 340-foot span twin trapezoidal steel box girders. Evaluated alternative bracing systems to control deformations and stresses during placement of composite concrete slab. Prepared final drawings and calculations to support owners approval of selected system.

Lewiston-Clarkston Bridge (Lewiston, Idaho – Clarkston, Washington)
***Design Engineer** (1978)* Designed a 1,750-foot long, 70-foot wide four-lane highway bridge over the Snake River. The main bridge has a central span of 610 feet with a single celled prestressed concrete box girder built using cast-in-place cantilevered construction. The bridge was cited as the first place winner of the FHWA Excellence in Highway Design - 1986 Biennial Award.

Ruck-A-Chucky Bridge (Auburn, California)
***Design Engineer** (1977)* Performed design and analysis for the "most famous bridge never built", a cable stayed span upstream of the Auburn Dam. To avoid piers in the deep reservoir, a 1300 foot span "hanging arc" bridge was designed. The stay cables are anchored on the valley slopes, configured to produce an axial line of pressure in the curved girder. Performed static and dynamic analyses of the steel and concrete design alternatives. Validated dynamic shaking table model tests.

PUBLICATIONS

1. Scordelis, A.C., and Ketchum, M.A., "Structural Behavior and Design of Saddle HP Shells", *Proceedings, World Congress on Shell and Spatial Structures*, Madrid, Spain, September 1979, pp. 4.239-4.254.
2. Ketchum, M.A., and Ketchum, M.S., "Preliminary Analysis and Design of Shell Structures", *Proceedings, American Society of Civil engineers Exposition*, Miami, Florida, October 27-31, 1980.
3. Ketchum, M.A., and Scordelis, A.C., "Nonlinear Analysis of a Prestressed Concrete Bridge", *Final Report, IABSE Colloquium on Advanced Mechanics of Reinforced Concrete*, Delft, Netherlands, June 1981, pp. 561-576.
4. Scordelis, A.C., and Ketchum, M.A., "Saddle Shells", *Hyperbolic Paraboloid Shells State of the Art*, Special Publication SP-110, American Concrete Institute, 1988, pp. 65-88.
5. Ketchum, M.A., and Heldermon, A., "Probing the Golden Gate", *Civil Engineering Magazine*, American Society of Civil Engineers, New York, June 1991.
6. Ketchum, M.A., "Twenty Years of Progress in Concrete Bridge Technology: Design, Analysis, and Construction", *Proceedings, Symposium on Structural Analysis and Assessment of Bridges*, Taipei, Taiwan, Republic of China, May 1992, pp. 6-9.
7. Ketchum, M.A., "Time Dependent Analysis of Segmental Concrete Bridges", *Proceedings, Symposium on Structural Analysis and Assessment of Bridges*, Taipei, Taiwan, Republic of China, May 1992, pp. 10-17.

8. Ketchum, M.A., "Golden Gate Bridge: Recent Evaluation for Rail Transit Feasibility and Wind Resistance", *Proceedings, Symposium on Structural Analysis and Assessment of Bridges*, Taipei, Taiwan, Republic of China, May 1992, pp. 18-21.
9. Ketchum, M.A., "Seismic Studies of the Golden Gate Bridge", *Proceedings, Symposium on Structural Analysis and Assessment of Bridges*, Taipei, Taiwan, Republic of China, May 1992, pp. 22-25.
10. Lin, T.Y., Cheng, K., and Ketchum, M.A., "Structural and Economic Comparison of Long Span Cable-Stayed vs. Suspension Bridges", *Proceedings, International Symposium on Cable Stayed Bridges*, Shanghai, China, January 1994.
11. Ketchum, M.A., and Cheng, K., "Seismic Analysis and Behavior of Three Major Western U.S. Suspension Bridges", *Proceedings of Conference on Cable-Stayed and Suspension Bridges*, Deauville, France, Oct. 1994, Volume 2, pp. 255-262.
12. Ketchum, M.A., and Waggoner, F., "Seismic Analysis of The West Bay Suspension Spans of the San Francisco – Oakland Bay Bridge", *Proceedings, National Seismic Conference on Bridges and Highways*, San Diego, California, Dec. 10-13 1995.
13. Subcommittee on Seismic Performance of Bridges (M.A. Ketchum et. al.), "Seismic Evaluation and Retrofitting of U.S. Long-Span Suspension Bridges - Issues and Solutions", *Proceedings, ASCE Structures Congress*, Chicago Illinois, April 1996.
14. Ketchum, M.A., and Chang, C.Y., "Seismic Susceptibility Study of the St. Johns Bridge", *Proceedings, ASCE Structures Congress*, Portland Oregon, April 1997.
15. Ketchum, M.A., and Cheng, K., "The Bi-Tan Pedestrian Suspension Bridge", *Proceedings, ASCE Structures Congress*, Portland Oregon, April 1997.
16. Ketchum, M.A., "Golden Gate Bridge Seismic Evaluation: Challenges, Solutions, and Precedents", *Proceedings, Earthquake Engineering Research Institute 50th Anniversary Technical Colloquium*, February 5-7, 1998.
17. Chang, C.-Y., Chin Man Mok, Z.-L. Wang, H. Gonnermann, M.A. Ketchum, and C.C. Chin, "Seismic Analysis of Large Caisson Foundations for Long-Span Bridges", *Proceedings, EERI*, June 1998.
18. Brierley-Green, D., Ketchum, M.A., and Singh, J.P., "Seismic Modeling and Analysis of the Tacoma Narrows Bridge", *Proceedings, Structural Engineers World Congress 1998*, San Francisco, California, July 1998.
19. Ketchum, M.A., Drouillard, F., and Scheld, J., "Pipeline Bridge across Arroyo Cangrejillo, Argentina", *Structural Engineering International*, Volume 9 Number 1, International Association for Bridge and Structural Engineering, Zurich, Feb. 1999.
20. Marquez, M., Orsolini, G., Ketchum, M., and Spoth, T., "Suspension Solution", *Civil Engineering Magazine*, American Society of Civil Engineers, New York, June 2000.
21. Mathur, R., Ketchum, M., Orsolini, G., and Chang, C.-Y., "Seismic Design of the New Carquinez Bridge", *Proceedings, International Bridge Conference*, Engineering Society of Western Pennsylvania, Pittsburgh, Pennsylvania, June 2001.
22. Mathur, R., Ketchum, M., and Orsolini, G., "Seismic Design of Concrete Towers of the New Carquinez Bridge", *Proceedings, Third National Seismic Conference and Workshop on Bridges and Highways*, Portland, Oregon, April 2002.

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23. Lin, T.Y., Cheng, K., Ketchum, M., Drouillard, F., and Scheld, J., "Design of the Ling-Tie Bridge", *Current and Future Trends in Bridge Design, Construction and Maintenance*, Shanghai, April 2003.

CONTACT INFORMATION

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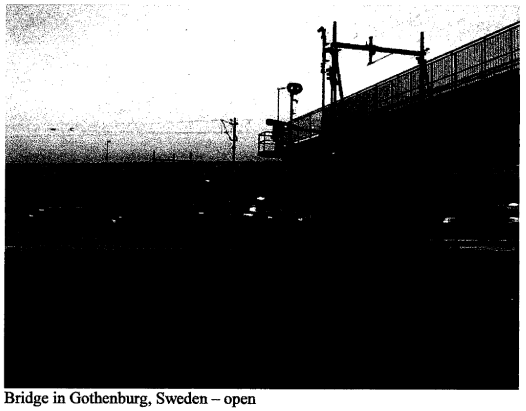
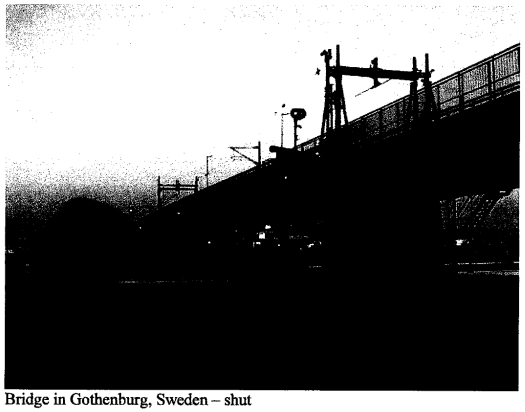
Attachment E

Swing Bridges in Europe



Bridge in Gothenburg, Sweden – open



Bridge in Gothenburg, Sweden – shut